

THE CLAIMS

1. A stabilized cyclosiloxane material for use as a dielectric precursor.
2. A stabilized siloxane dielectric precursor comprising a siloxane reagent dosed with a stabilizing agent(s) selected from free-radical inhibitors, end-capping agents and mixtures thereof.
3. The stabilized siloxane dielectric precursor according to claim 1, wherein said siloxane reagent is of the formula:



wherein each of R and R' is same or different and independently selected from the group consisting of hydrogen, C₁-C₈ alkyl, C₁-C₈ alkoxy, C₁-C₈ alkene, C₁-C₈ alkyne, and C₁-C₈ carboxyl; and n is from 2 to 8.

4. The stabilized siloxane dielectric precursor according to claim 1, wherein said siloxane reagent is selected from the group consisting of: polyhedral oligomeric silsesquioxanes (POSS), octamethylcyclotetrasiloxane (OMCTS), hexamethylcyclotetra-siloxane (HMCTS), tetramethylcyclotetrasiloxane (TMCTS), and mixtures thereof.
5. The stabilized siloxane dielectric precursor according to claim 1, wherein said siloxane reagent is 1,3,5,7- tetramethylcyclotetrasiloxane (TMCTS).
6. The stabilized siloxane dielectric precursor according to claim 1, wherein said stabilizing agent is present in a concentration range from about 0.01% to 10.0 % by weight.
7. The stabilized siloxane dielectric precursor according to claim 1, wherein said stabilizing agent is present in a concentration range from about 0.05 to 1.00 % by weight.
8. The stabilized siloxane dielectric precursor according to claim 1, wherein said stabilizing agent is an end-capping agent.

9. The stabilized siloxane dielectric precursor according to claim 1, wherein said end-capping agent reacts with hydroxyl or radical groups resulting from cleavage of a [Si-O] bond of the siloxane dielectric precursor.
10. The stabilized siloxane dielectric precursor according to claim 1, wherein said end-capping agent includes a monofunctional-silylating agents having a formula $R^1R^2R^3SiX$, wherein X is a reactive site, selected from but not limited to, H, OH, silyloxy, nitrogen-containing silyl, each of R^1 , R^2 and R^3 are same or different and independently selected from hydrogen, C_1 - C_8 alkyl, C_5 - C_{12} aryl.
11. The stabilized siloxane dielectric precursor according to claim 1, wherein said end-capping agent is selected from the group consisting of: naphthylphenylmethylsilanol (NPMS), silyl-N-methylacetamides, trifluoropropyl dimethylsilyl-N-methylacetamide (TFSA) bis(trimethylsiloxy)methylsilane, and hexamethyldisilazane.
12. The stabilized siloxane dielectric precursor according to claim 1, wherein said stabilizing agent is a free-radical inhibitor that stops free-radical polymerization of activated siloxanes by reacting therewith.
13. The stabilized siloxane dielectric precursor according to claim 12, wherein said stabilizing agent is a phenol.
14. The stabilized siloxane dielectric precursor according to claim 12, wherein said stabilizing agent is a hindered phenol.
15. The stabilized siloxane dielectric precursor according to claim 12, wherein said stabilizing agent is selected from the group consisting of butylated hydroxy toluene (BHT), hydroquinone, butylated hydroxy toluene, (BHT), butylated hydro anisole (BHA) and diphenylamine.
16. A process for stabilizing a cyclosiloxane dielectric precursor, including, dosing a cyclosiloxane reagent with a stabilizing agent selected from the group consisting of: free-radical inhibitors, end-capping reagents and mixtures thereof.

17. The process according to claim 16, wherein said stabilizing agent is present in a concentration range from about 0.01% to 10.0 % by weight.

18. The process according to claim 16, wherein said stabilizing agent is present in a concentration range from about 0.05 to 1.00 % by weight.

19. The process according to claim 16, further comprising a purification step.

20. The process according to claim 19, wherein said dosing occurs before, after or during said purification step.

21. The process according to claim 19, wherein said purification step is selected from the group consisting of

(1) contacting the cyclosiloxane dielectric precursor with an adsorbent bed material, so as to remove therefrom at least a portion of the water, and optionally at least one other impurity, to produce a cyclosiloxane precursor having a reduced level of water and optionally at least one other impurity; and removing the purified cyclosiloxane precursor from the adsorbent bed material; and

(2) distilling a starting mixture comprising at least water and at least one cyclosiloxane dielectric precursor, in the presence of an azeotropic component, so as to form an azeotropic mixture with the water contained in said starting mixture; in order to produce (A) a distillate fraction comprising water and the azeotropic component and (B) a balance fraction comprising cyclosiloxane, whereby said balance fraction (B) is substantially reduced in water relative to said starting mixture; and

(3) a combination of 1 and 2;

22. The process according to claim 19, wherein said purification step reduces concentrations of water and trace acids in cyclosiloxanes to levels in a range of from about 1 to 20 ppm and from about 0.001 to 0.00001 wt %, respectively.

23. A CVD process for depositing a low dielectric constant thin film on a substrate comprising chemical vapor depositing a dielectric thin film layer on a semiconductor substrate from a cyclosiloxane reagent dosed with a stabilizing agent selected from the group consisting of, free-radical inhibitors, end-capping reagents and mixtures thereof.

24. The CVD process according to claim 23, further comprising:

placing the substrate in a chemical vapor deposition apparatus;

introducing at least one cyclosiloxane reagent dosed with a stabilizing agent into the apparatus;

vaporizing the cyclosiloxane reagent;

transporting the vaporized cyclosiloxane reagent into a chemical vapor deposition zone containing the substrate, optionally using a carrier gas to affect such transport;

contacting the cyclosiloxane vapor with the substrate under chemical vapor deposition conditions to deposit a thin film comprising an organosilicon composition; and

annealing the organosilicon thin film to produce a porous, SiCOH, low dielectric constant thin film.

25. The CVD process according to claim 23, comprising residual process gases such as NH_3 , O_2 and CO_2 .